

Patent Claims

1. Circuit (3) for reducing the crest factor of a data symbol (X) to be transmitted in a multi-carrier data transmission system (1), in which the data symbol (X) to be transmitted is a function of a multiplicity of signals provided within a predetermined time interval and each of these signals is allocated to a carrier, each carrier occupying in each case at least one frequency from a transmit data spectrum, at least one carrier being reserved which is not provided for the data transmission,
- (A) with a transmit path (5) with a data symbol (X) to be transmitted;
- (B) with a model path (6),
- which is arranged in parallel with a section of the transmit path (5),
  - which exhibits a model filter (12) to which the non-oversampled data symbol (X) to be transmitted can be supplied the non-oversampled data symbol (X) exhibiting a non-flat PSD power spectrum,
  - which exhibits an analysis and evaluation circuit (13) which is arranged following the model filter (12) and which checks whether the time domain function of the data symbol (X) to be transmitted exhibits within a predetermined time interval at least one maximum, the amount of which exceeds a first threshold and/or determines the associated position of the maximum within the time interval, and which, by scaling and displacing a dirac-like sample function generates a correction function ( $Y_{cf}$ ) in dependence on the position and the amplitude of the maximum;
- (C) with a subtracting device (10) which is connected to outputs of the model path (6) and of the transmit path (5) and which subtracts the correction function ( $Y_{cf}$ ) from the data symbol (X)

to be transmitted.

2. Circuit according to Claim 1, characterized in that on the model path (6), an oversampling device (11) and a bypass device (19) for bypassing the oversampling device (11) is provided.

3. Circuit according to Claim 2, characterized in that on the model path (6), a switching device (20) is provided which precedes the oversampling device (11) and the bypass device (19) and which forwards the data symbol (X) either via the bypass device (19) or via the oversampling unit (11).

4. Circuit according to one of Claims 2 or 3, characterized in that the oversampling device (11) performs 2-fold oversampling of the data symbol (X).

5. Circuit according to one of the preceding claims, characterized in that the model filter (12) is designed in such a manner that its filter coefficients are identical both for a data symbol (X) supplied to the model filter (12) via the oversampling device (11) and for a data symbol (X) supplied to the model filter (12) via the bypass device (19).

6. Circuit according to one of the preceding claims, characterized in that the model filter (12) is constructed as a non-recursive filter (12), particularly as an FIR filter (12), which has the characteristic of a filter (4) following the circuit for reducing the crest factor(3).

7. Multi-mode modem for a multi-carrier data transmission system, which exhibits a circuit for reducing the crest factor (3) according to one of the preceding claims and which is designed for transmitting transmit signals (X), which exhibit a power density spectrum according to the PSD mask (21, 22) both

according to the ADSL standard and according to the ADSL+ standard.

8. Method for reducing the crest factor of a data  
5 symbol (X) to be transmitted by means of a circuit (3)  
according to one of Claims 1 to 6, in which the data  
symbol (X) to be transmitted is oversampled 2-fold in  
the case of an ADSL data transmission and is not  
oversampled in the case of an ADSL+ data transmission.

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9. Method according to Claim 8, characterized in that  
the filter operations of a model filter (12) on the  
model path (6) are performed with a single sampling  
rate, both for a 2-fold oversampled ADSL data symbol  
15 (X) and for a non-sampled ADSL+ data symbol (X).

10. Method according to one of Claims 8 or 9,  
characterized in that in each case correction functions  
of constant length are used both for the ADSL data  
20 transmission and for the ADSL+ data transmission.

11. Method for reducing the crest factor of a data  
symbol (X) to be transmitted by means of a circuit (3)  
according to one of Claims 1 to 6, in which L-fold  
25 oversampling of the data symbol (X) to be transmitted  
occurs on the model path (6), only a single sample  
correction signal for reducing the crest factor being  
stored for the model path (6) and the remaining L-1  
sample correction signals being derived by means of  
30 cyclic time displacement and scaling in the time  
domain.

12. Method according to Claim 11, characterized in  
that such dirac-like sample correction signals, whose  
35 time-displaced variants with aliasing are as similar to  
one another as possible are selected for reducing the  
crest factor.